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BALLISTIC MISSILE AND SPACE LAUNCH VEHICLES OF CHINA,(U)
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FOREIGN TECHNOLOGY DIVISION

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by

Dong Gong

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BALLISTIC MISSILE AND SPACE LAUNCH VEHICLES OF CHINA

by Dong Gong

The strategic missile and space launch vehicles of China are products of the three major development stages of China's space launchers. The achievements of these three major stages have provided China with respectable satellite launch and medium-to-long range nuclear missile strike capabilities. The CSS-1 missile, a product of China's first major development stage in launchers, carries a 20 kiloton nuclear warhead and has a range of about 1,200 kilometers. There have been 50 to 90 of these types of missiles deployed and targeted against the Soviet Union. The CSS-1 is a single stage missile utilizing RP-1 and liquid oxygen propellants. China improved the Soviet SS-3 missile into the CSS-1 missile. The missile was China's first important development in the area of strategic missiles and was first developed in about 1966.

The CSS-2 missile was a product of China's second major development stage. This missile has a 1,500 kg nuclear warhead with an equivalent weight of at least 1-megaton and has a target range of over 2,495 kilometers. The CSS-2 missile uses unsymmetrical dimethyl hydrazine and dinitrogen teroxide fuel, is 20.4 meters in height and has a diameter of 2.4 meters. It is believed that about 20 of these missiles have been deployed since 1971. The experience of developing the CSS-2 allowed the Chinese to be able to develop

the CSS-3 two stage ICBM and the first stage of the CSL-1 three stage space launch vehicle. The capacity of the CSS-3 ICBM warhead is no less than 1-megaton and its maximum range is 7,000 kilometers. The CSL-1 "Long March No. 1" booster launched China's first and second space flight satellites in April,1970 and March, 1971. The engine used in the CSS-2, CSS-3 and first stage of the CSL-1 had four spray nozzles.

China's third space launcher, also a product of the highest major development stage, is the CSS-X-4 two stage ICBM. Its maximum potential range is 10,000 kilometers and its demonstrated maximum range is 8,050 kilometers. Tests of this missile carried out on May 18 and May 20 of this year had flights of 5,000 and 4,200 miles. The test on May 21 was possibly a failure because the spash down point of the test data recovered by the navy in the Pacific Ocean was very far from the point the vehicle was deployed. The aircraft has carried out relatively short-range flight tests within Chinese territory. The data recordings carried in the cabin and the recovery equipment which used a parachute landing were picked up by a ground unit. This missile can carry a 3,180 to 4,995 kg weight nuclear warhead with an equivalent weight of a 5 megaton TNT explosive. Although the CSS-X-4 ICBM has still not developed to an actual combat stage, it has been used by the CSL-2 space launch vehicle and has been named the FB-1 by the Chinese. The FB-1 can launch an effective load of 1,200 kilograms into a 150 kilometer inertial orbit. The volume measurements of the FB-1 and CSS-X-4 are about 33 meters in length, 3.3 meters in diameter and 190 tons in weight. The envelope is 4% copper/aluminum alloy and uses a chemical method for grinding. The second stage rocket is 11.95 meters in

length and 40 tons in weight. The single fixed engine of the second stage rocket and the four engines of the first stage rocket both utilize di-nitrogen teroxide and unsymmetrical dimethyl hydrazine propellants and each engine produces 70 tons of power. The engines are made of stainless steel and the turbine pumps are forged from aluminum. The expansion ratios of the engines are 10:1 and combustion chamber pressure is 71 atmospheric pressure. The engine spray nozzles have direct blast. The engine of the first stage rocket is fitted with 10° universal joints and the four part fine tuned engine in the second stage rocket is also fitted with 10° universal joints. The gross thrust of the fine tuned engine is 4,500 kg. The main pipes of each engine are used to join the self pressurized system to the propellant tank. The FB-1 and CSS-X-4 are both inertia guided. Beginning in July of 1975, the FB-1 has launched 3 to 8 man-made Chinese satellites. The two differently designed CSS-X-4 and CSS-2 re-entry vehicles and the space aircraft shield on the FB-1 have gained the attention of Western observers.

The CSL-3, a space vehicle designed and manufactured by China, is a type of rocket which will use the first and second stage propellers of the FB-1 space vehicle, add on a section using liquid oxygen and liquid hydrogen as fuel and have a third stage rocket with a thrust of 4,540 kg which will raise it to become a three stage launch vehicle. The addition of a high energy upper stage will cause the length of the rocket to increase about 10.4 meters above the present 33 meters. The inserted drawing of the third stage rocket is a conceptual drawing of the outside of this type of launch vehicle. The "Long March No. 3" will possibly be able to be flight tested

in 1981 or 1982. China does not use the name "Long March No. 2." The CSS and CSL nomenclatures are American names.

American analysts think that the performances of the CSS-X-4 and FB-1 are lacking as compared to the performances they had inferred this size launch rocket should have. The similar expansion ratios used by China in the engines of the first and second stage rockets astonished American analysts. China is in the process of further developing rocket engines so as to raise their thrust. While developing engine combustion chambers they encountered many difficult to handle problems. The combustion chamber is composed of a cylindrical flat spray nozzle board and a nozzle arranged along a high line. The inner and outer walls of the combustion chamber are welded to form a cooling casing. It is believed that China's use of the propellant system pressurized method is dinitrogen teroxide poured into the engine turbine rotary exhaust on one side of the heat exchanger. This makes the dinitrogen teroxide evaporate thus causing the oxidizing agent tank to pressurize. They use an engine turbine pump to cause the spent gas to pass through the cooler and afterwards use them to pressurize the fuel tank. China has already developed a solid rocket fuel and this will be even more adaptable to China's ICBM than the present liquid fuel launch vehicles. The thrust formed during ignition of the CSS-X-4 and FB-1 does not produce pressure for the launch pad. There is used a wind tank type wind tunnel from the fuel tank of the first stage rocket to the engine's propellant piping in the first stage rocket and the inside fuel is transported in a duct like the Boeing S1-C. An NASA and American Aviation and Space Cooperation Group visited the Shanghai factory which produces the FB-1 and this factory had 1,500 staff and workers.

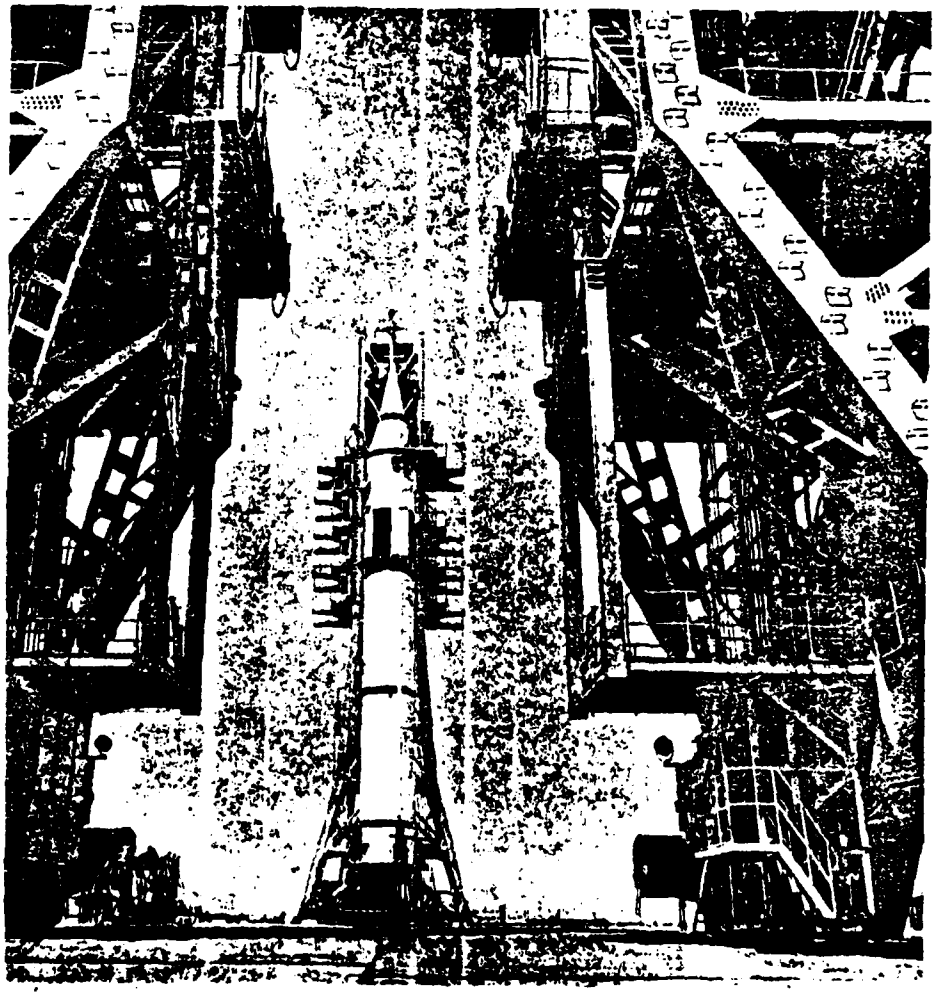
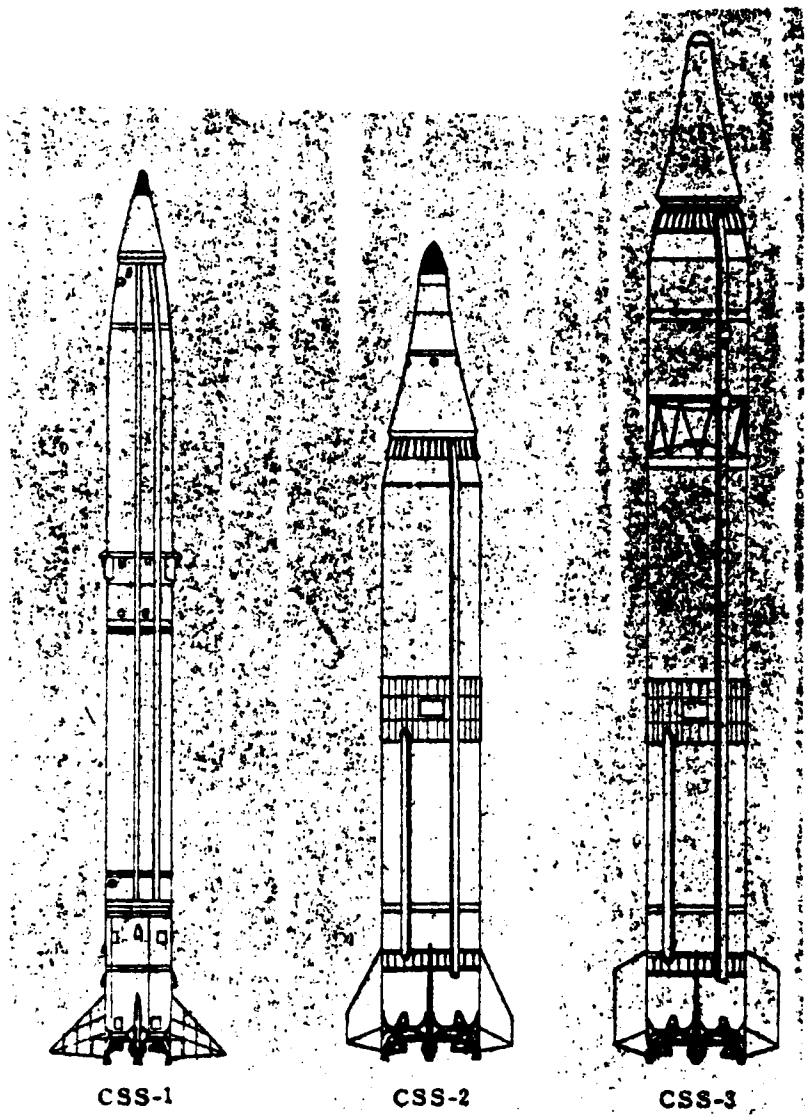


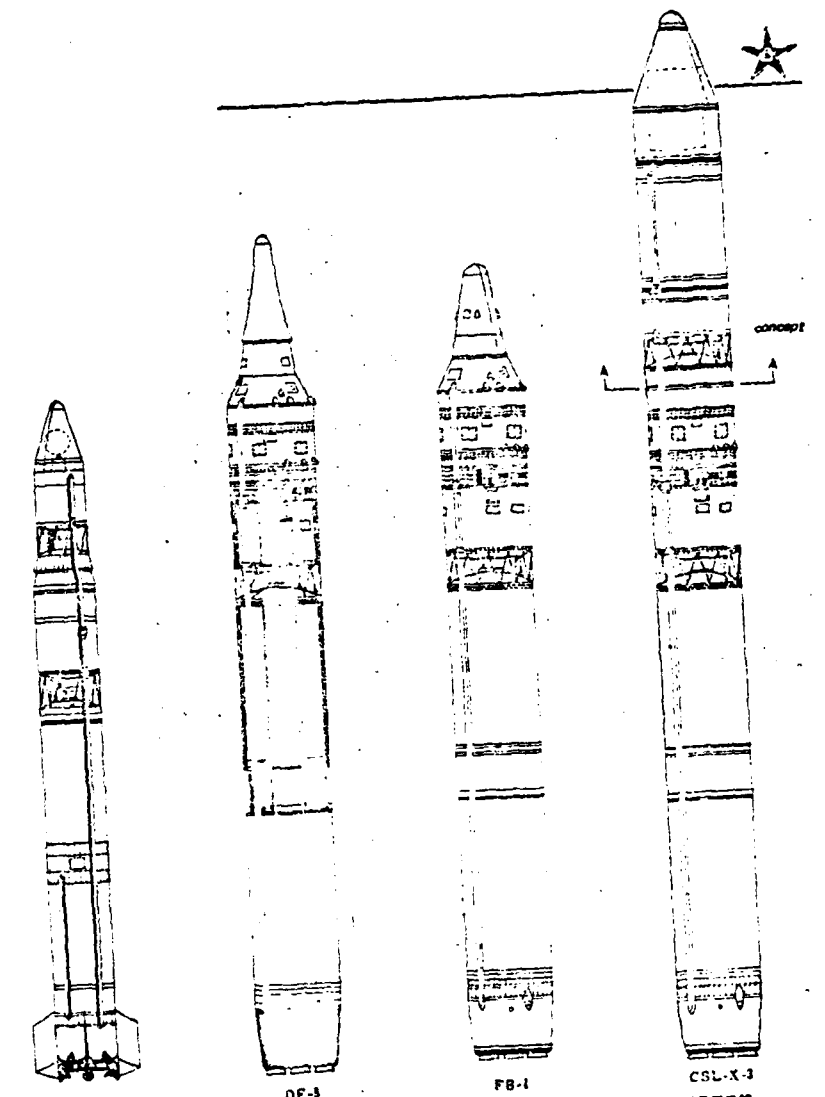
Photo 1

Chinese DF-5/CSS-X-4 ICBM undergoes final preparations at the launching site.



Drawing 2

*The"China 1" is called "Dong Fan Hong No. 1" in China.
Other Chinese satellites' names not available.



CSL-1
「長征一號」 LONG MARCH No. 1
「東方紅一號」和「中繼二號」
CHINA 1 – 2*

DF-5
CSS-X-4

FB-1
CSL-2
「中繼三號」至「八號」
CHINA 3 – 8

CSL-X-3
「長征三號」
LONG MARCH No. 3

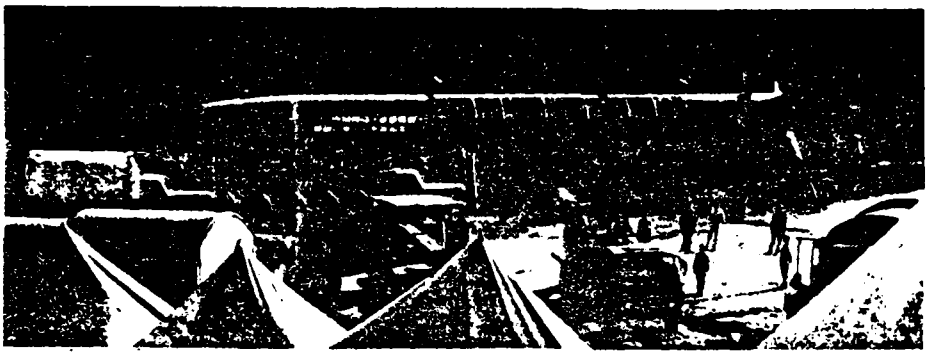
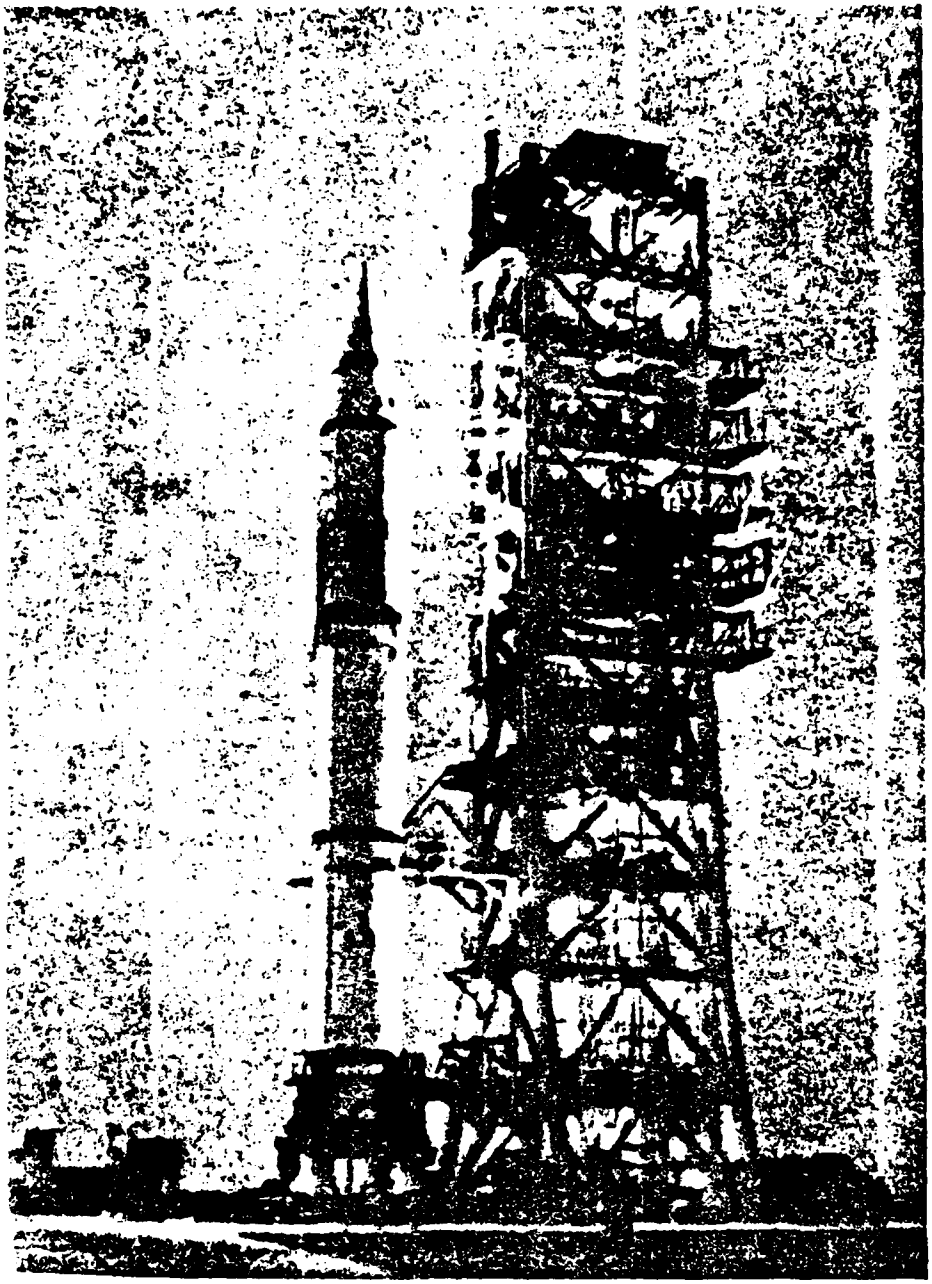


Photo 4

A PLA's missile unit armed with the old CSS-1 MRBM camping out for field training.



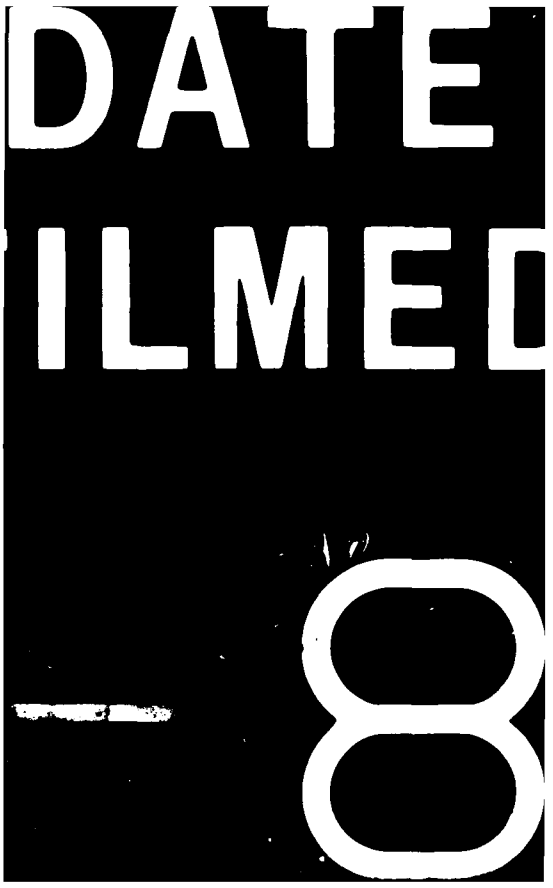
A Chinese DF-5/CSS-X-4 ICBM standing on the launching pod.

Photo 5

Abstract

Strategic Missile and Space Launch Vehicles of China

After some twenty years of relentless efforts, China has now acquired a respectable satellite launch and medium-to-long range nuclear strike capability. Activities in strategic weapon research and development started in the early sixties. The Soviet SS-3 were modified to form the CSS-1 missile and has been deployed and targeted against the Soviet Union. CSS-1 carries a 20-kiloton warhead and has a range of about 1,200km. It is a single stage vehicle utilizing RP-1 and liquid oxygen propellents. Further advance along the line was represented by the CSS-2, another single stage vehicle having a target range of about 2,495km. It carries a 1,500kg warhead which yields at least 1-megaton. On the basis of the about achievements, the CSS-3 two-stage ICBM and the CSL-1 three-stage space launcher came into being in the seventies. Maximum range of the CSS-3 ICBM is 7,000km, and the capacity of its warhead is at least 1-megaton. Latest in China's strategic missile inventory is the CSS-X-4, a two stage experimental ICBM with an demonstrated maximum range of 8,050 km. It is capable of transporting a 5-megaton warhead weighing about 3,180 km. The first and second stage of CSS-X-4 plus a liquid oxygen/hydrogen third stage will be incorporated to power a planned new Chinese launcher the CSL-X-3, which reportedly will be flight tested in the next two years.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